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Name of Invention: A Filter With Anti-bacterial Action

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SPECIFICATION

1. Name of the Invention

A filter with Anti-bacterial Action

2. Claims

A filter with anti-bacterial action for use in sterile filtration characterized by its ability to suppress or prevent the increase of microorganism growth on the surface of a filter membrane by forming a thin silver coating using a physical spray or chemical spray method onto the source solution side of the filter membrane.

3. Detailed Explanation of the Invention

(Areas of Industrial Utility)

This invention describes the process of sterile filtration where a filter membrane is used through a body of fluid to remove microorganisms scattered in a gaseous or liquid environment. The filter membrane possessing the anti-bacterial action of this invention is used in various areas; in a liquid atmosphere application, for example, a household water cooler, filtering for draft beer and fresh sake or sterile filtering of water; and in the application to a gaseous atmosphere, a gas tank (illegible) attached to ampules for medical use, a controller for atmospheric (illegible) manufacturing process, or an ambient atmosphere controller for (illegible), manufacturing of sterile inactive gas or air to be used in dilutions or adjustments of atmosphere.

(Conventional Technology)

As methods to remove or sterilize microorganisms that are contained in a fluid (liquid and gas), there are filter sterilization methods using fine membrane filters and exclusion filtering, ultraviolet illumination method and heat treatment method; however, as the final sterilization method, this filter sterilization method is used extensively. This method can be used in continuous processing without heating or drug treatment, thus it is broadly used in various fields.

As filter membrane materials, high density polymers or heat resistant and (illegible) multi-pore (illegible), etc. are used, such as cellulose acetate, cellulose nitrate, regenerated cellulose, teflon, polysulfone, polyacrylonitrile, polyamide, polyimide, polyethylsulfone.

(Problems This Invention Attempts to Solve)

(the bottom part of this page is illegible; two sentences.) the miniaturized microorganisms such as these create a dangerous possibility of passing through the micropores of the fine membrane filter and collecting into the filtrate. Many cases have been reported in which bacteria have been found, especially when a filtration treatment is temporarily halted and resumed after a period of time has passed.

(Procedures to Solve the Problems)

The present inventors, having researched with the intention

of solving the above mentioned problems, produced this invention.

The principle of this invention is the addition of anti-bacterial action to the surface of the source liquid side of a filter membrane itself by spraying silver known for its anti-bacterial property with a physical spraying method or chemical spraying method.

By using the filter with the anti-bacterial action of this invention, it is possible to prevent the passing of microorganisms into the filtrate, because of its ability to prevent or suppress the growth of microorganisms on the surface of a filter membrane, which is the weakness of the conventional technology.

Various materials can be used as the filter membrane for this invention, including all the membranes which can be treated with silver, such as fine filter membrane, filter cloth, filter paper, etc. and the raw material can be cellulose acetate, teflon, polysulfone, and many other materials. Moreover, the design of the filter can be flat film, spiral, pleat, tubing, hollow fiber module and many others.

(Working Example)

Described below are working examples of this invention and also comparison examples using materials other than this invention.

Each working example and comparison example used the filter path illustrated in Figure 1. In Figure 1, a sterile filter device is shown as 1, an air filter for sterile operation as 2, reagent

containing bacteria as 3, filter membrane with silver coating or comparison membrane (no silver coating) as 4, filtering solution as 5, leak valve to return to the atmospheric pressure after the filter operation as 6, and suction pump as 7. The filtering operation was conducted as follows: The bacteria containing solution 3 was filtered through a silver coated filter membrane or comparison membrane 4 (both were fine filter membranes manufactured by Fuji Film Co. Ltd.; tri-acetate cellulose film, specified pore size of 0.45 um, diameter 47 mm, flat membrane), drawn by suction pump 7 to the pressure on the filter solution side of 100 mm Hg to pass through a total of predetermined amount (250 ml) of solution, then the membrane 4 used in filtering was cultured on the agar culture of the formulation described in Table 1 for 7 days at 37°C. Then, by counting the number of colonies grown, the degree of anti-bacteria action of the silver coated filter membrane was evaluated. The effective area of filtration of the filter membrane used herein was about 10 cm^2.

Table 1 Agar Culture for E. coli

Trypsin	10 g
Yeast Extract	3 g
Sodium Chloride	5 g
Agar	15 g
Purified Water	1000 ml
pH	7.6

Working Exampl 1

250 ml of test solution adjusted to contain E. coli concentration of 860 colonies/l was passed through the above described silver coated filter membrane by suction. This filter was cultured on the agar culture for 7 days at 37°C. The result is listed in Table 2.

Comparison Example 1

250 ml of test solution adjusted to contain E. coli concentration of 860 colonies/l was passed through the above described non-silver coated filter membrane by suction. This filter was cultured on the agar culture for 7 days at 37°C. The result is listed in Table 2.

Working Example 2

250 ml of test solution adjusted to contain E. coli concentration of 4×10^6 colonies/l was passed through the above described silver coated filter membrane by suction. This filter was cultured on the agar culture for 7 days at 37°C. The result is listed in Table 2.

Comparison Example 2

250 ml of test solution adjusted to contain E. coli concentration of 4×10^6 colonies/l was passed through the above described non-silver coated filter membrane by suction. This filter was cultured on the agar culture for 7 days at 37°C. The

result is listed in Table 2.

Table 2 Working Examples and Comparison Examples

	Bacteria concentration in test solution (colonies/1000ml)	Amount of Silver Coated (ug/unit*)	Number of New Colonies (colonies/unit*)
Working Example 1	860	1000	0
Comparison Example 1	860	--	215
Working Example 2	4×10^6	1000	0
Comparison Example 2	4×10^6	--	**

Note 1) * designates a corresponding value for each filter membrane.

Note 2) ** designates that the number of new colonies is too large to count.

(Merit of the Invention)

As shown above, it has been proven that the silver coated filter membrane possesses effectiveness in preventing or suppressing the increase of microorganisms accumulated on the surface of filter membrane during sterile filtration.

4. A Short Description of the Drawing

Figure 1 is the filtration pathway for the working examples and comparison examples.

In the Figure, 1 is the sterile filtration device, 2 is the air filter, 3 is the reagent, 4 is the silver coated (or non silver coated) filter membrane, 5 is the filter solution, 6 is the leak valve, and 7 is the suction pump.

Continuation from page 1.

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